The Marine Air Ground Task Force Expeditionary Family (MAGTF) of Fighting Vehicles (MEFFV) – Assault Variant Design: Recommendations for Urban Battle

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Subject Area Warfighting

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I want to thank my wife for the hours she spent running interference on the kids, giving me time to research, think, and write.

EXECUTIVE SUMMARY

Title: The Marine Air Ground Task Force Expeditionary Family (MAGTF) of Fighting Vehicles (MEFFV) – Assault Variant Design: Recommendations for Urban Battle.

Author: Major Michael R. Pfister, United States Marine Corps

Purpose: This paper recommends design considerations in order to prepare the Assault Variant for urban warfare.

Discussion.

The future battlefield will be the urban arena. Underdeveloped countries are producing vast urban slums at an alarming rate. Suspended in underprivileged conditions such as poverty, starvation, and disease, this class will seek change through radical means creating regional crisis. With the United States politically and economically engaged throughout the globe, such a crisis may threaten U.S. interests requiring a military response. Additionally, our adversaries realize the futility in challenging the U.S. military on open, unrestricted ground; therefore, they will seek to degrade U.S. abilities in the restrictive terrain of cities.

Though designed for long range, direct fire engagements, history has shown that tanks have excellent utility in urban fighting. This has been proven again during recent experiments designed to create effective urban tactics. The MEFFV Program's Assault Variant will replace the premier capabilities of the M1A1 Main Battle Tank in the year 2020. The Assault Variant's design supports the concepts within *Expeditionary Maneuver Warfare - Seabasing, Ship to Objective Maneuver,* and *Sustained Operations Ashore* - creating a smaller, lighter, and more logistically efficient design. Of concern is that this design is not appropriate for fighting in urban areas.

Conclusion:

In order to prepare the Assault Variant for likely urban warfare, this paper offers sensible urban-minded recommendations to the Assault Variant's firepower, protection, mobility, and command and control systems, as well as its training regimen.

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CHAPTER 1

SHAPING THE ISSUE

> *To ensure the U.S. military has the ability to effectively operate on the urban battlefield, the CINCs and services must continue to expand their present efforts of study and understanding of the urban environment and must develop an integrated approach that optimizes key warfighting capabilities for future operations on urban terrain.*
>
> --Defense Planning Guidance, FY00-05, 1998[1]

Numerous studies conducted within the Department of Defense (DoD) and by independent think tanks conclude that future conflict will have the proclivity of occurring in urban areas. "U.S. urban capabilities are based on a massive rural war in Central Europe and require revision"[2] and services need to "develop an integrated approach that optimizes key warfighting capabilities for future operations on urban terrain"[3] are two of many examples steering the services to prepare to "go urban." Undoubtedly, urban debacles such as Russia's horrific experience in Grozny in

[1] Major Chris Beckert, USA, *Building a Better Trojan Horse*, Research Study (Fort Leavenworth, Kansas: School of Advanced Military Studies, 2000), 4. URL: http://www.army.mil/products/mout/misc-pubs/trojan-horse.pdf>, np, accessed 24 February 2003.
[2] Major Norman L. Cooling, USMC, *Shaping the Battlespace To Win the Street* Fight, Masters Thesis (Quantico, Virginia: Marine Corps Command and Staff College, 2000), 126.
[3] Beckert, 4.

1994 and our experience in Mogadishu in 1993 reinforced the findings of such studies.

COMING TO GRIPS

Creating a more effective urban capability requires creation or refinement in the areas of doctrine, organization, training, and equipment. All of the Services have gradually applied more time and resources in creating this capability with the Army and the Marine Corps naturally being the most active. Of the two, the Marine Corps has demonstrated a more concerned interest. For example, in 1997, the Marine Corps Combat Development Command released "A Concept for Future Military Operations on Urbanized Terrain," a clarion call to guide future urban warfare research and experimentation.[4] The following year, the Marine Corps Warfighting Laboratory (MCWL) began a two-year series of exercises under the name URBAN WARRIOR testing urban warfighting capabilities in "living" cities such as Chicago, Illinois; Jacksonville, Florida; and San Francisco and Oakland, California.[5] Today, similar follow-on

[4] Marine Corps Combat Development Command, *United States Marine Corps Warfighting Concepts for the 21st* Century (Quantico, Virginia: MCCDC, 1999), np.
[5] Randolph Gangle, "Training for Urban Operations in the 21st Century," *Marine Corps Gazette*, July 2001, 23.

experimentation continues under the organization PROJECT METROPLIS. This organization is charged with further developing and refining new tactics, techniques, and procedures (TTPs) for urban fighting.

To date, this training and experimentation has given the Marine Corps noticeable improvements in current doctrine, training, and organization; but what about equipment?

WHAT ABOUT EQUIPMENT?

Historically, the U.S. military has had a "come as you are" approach to urban warfare and found that their equipment, designed towards open-field or "Desert Storm" style warfare, was not suited for combat in cities. The call for designing equipment suited for urban combat has mostly come from field grade officers such as Major Ralph Peters and Major Norman L. Cooling. Major Peters' 1996 *Parameters* article "Our Soldiers, Their Cities" states that "our long for gallant struggles in green fields" has left us improperly equipped for urban operations.[6] Major Norman L. Cooling's Academic Year 1999-2000 Student Research Paper, "Shaping the Battlespace to Win the Street Fight", similarly calls for

[6] Major Ralph Peters, USA, "Our Soldiers, Their Cities," *Parameters*, Spring 1996, np. URL: http://www.army.mil/usawc/parameters/96Spring>, np, accessed 17 December 2002.

suitable equipment, recommending that future acquisition programs be scrutinized to ensure the equipment is designed with the urban environment in mind.[7]

The purpose of this paper is to echo this call for urban-capable equipment. Specifically, this paper will make recommendations for the design of the Assault Variant, the proposed replacement for the M1A1 Main Battle Tank. Scheduled for fielding in 2020, now is the opportune time to ensure the Assault Variant is designed with the "urban environment in mind." This paper will begin by describing the growing urban arena to show why this is the future battleground. Next, the paper will explain the Assault Variant's design parameters influenced by its baseline program - the Marine Air Ground Task Force Expeditionary Family of Fighting Vehicles (MEFFV). It is then necessary to examine some operating concepts for conducting urban operations and how tanks may be employed. Finally, in order to assist the future Assault Variant crewman, this paper will make recommendations for the Assault Variant's designers to consider.

[7] Cooling, 164.

CHAPTER 2

THE URBAN ARENA

The threat in the early years of the next century will not be the "son of Desert Storm" – it will be the "stepchild of Chechnya.[8]

General Charles C. Krulak
31st Commandant of the Marine Corps

In 1997, this author listened to General Krulak argue this point. For visual proof, he utilized an image showing data collection of electronic activity throughout the world. The image did not include the world's landmasses, however, the electronic activity collected over a 30-day period outlined the continents to include numerous major urban centers along the coastlines. His thesis was that future warfare would more then likely occur in these urban centers and therefore the Marine Corps must prepare for urban combat. Further, he speculated that the combat conducted in these cities would not resemble the urban warfare that our fathers or grandfathers knew in the Second World War. It would resemble something he referred to as the "three-block war." This concept envisions a Marine in an urban environment along

[8] General Charles C. Krulak, General, "Operational Maneuver from the Sea," *Joint Forces Quarterly*, Spring 1999, 79.

the littorals, providing humanitarian assistance in the morning; conducting peacekeeping by mid-day; and, fighting in intense urban combat in the evening.

General Krulak's brief did not intend to provide a daily urban schedule; rather, it served to explain the complexities of future urban combat and to warn tactical leaders where they may be sent to defend national interests.

COLLISION COURSE – U.S. INTERESTS AND URBANIZATION

Global urbanization did not receive much attention from mainstream military thinking or writing prior to the 1990s due to our preparation for a massive mechanized war in Europe. Today, the global urbanization topic surfaces more and more and for good reason. The facts and figures of this phenomenon are truly astounding and once known to any tactical, operational, or strategic leader, will convince them that our national interests will likely collide with the negative effects of urbanization.

Dr. Kingsley Davis, the well-known demographer and sociologist, observed that prior to 1900 only one country had a larger urban population than a rural population. But at the time of Dr. Davis' observation (1965) urbanization was

rapidly occurring and all industrialized countries had a larger urban population than rural population.[9] From 1959 to 1999, it is estimated that urban areas grew from a population of 737 million to 2.5 billion.[10] Current migration estimates reveal that urban areas are expanding by 160,000 people per day[11] and in less than eight years, will house more than 75 percent of the world's population.[12]

These urban areas – cities - have become so large and expansive that terminology is used to describe this phenomenon. Terms such as "boom cities," "reservoir cities," and "dispersed cities" are used to describe their characteristics. For example, the "dispersed cities" are the clusters of cities that surround a major city such as the Washington D.C. area excluding the city of Washington.[13] When a city builds to over 10 million residents, it gains the distinction of being a "mega-city." In fact, in 1985 there were already eight mega-cities in the world. This number

[9] Major Peters, 4.
[10] General Terrence R. Dake, USMC, "The City's Many Faces: Investigating the Multifold Challenges of Urban Operations," Unpublished Presentation (Washington DC: Headquarters, United States Marine Corps, April 1999), np, URL: http://www.rand.org/publications/cf/cf148/cf148.appg.pdf>, accessed 27 January 2003.
[11] Dake, np.
[12] Lieutenant Colonel Charles C. Taylor, USA, *Military Transformation for Warfare in the 21st Century: Balancing Implications of Urban Operations and Emerging Joint Operational* Concept, Strategy Research Paper (Carlisle Barracks, Pennsylvania: United States Army War College, 2002), 1, URL: http://www.army.mil/srp/ex_paper/Taylor>, accessed 16 December 2002.
[13] Lieutenant Colonel Ralph Peters, USA, "The Future of Armored Warfare", *Parameters*, Autumn 1997, 4, URL: <http//www.army.mil/usawc/ parameters/97Autumn>, accessed 17 December 2002.

grew to 19 by the year 2000. Within the next 15 years, 15 additional cities are expected to reach the “mega-city” distinction. The concern is not the general expansion of cities, but where the preponderance of this urbanization is occurring.

With the end of the Cold War the U.S. has become more imbedded in the global economy and more politically engaged to promote stability. This is difficult in a world that has grown increasingly volatile since the beginning of the 1990s. Consider the findings by the Carnegie Commission on Preventing Deadly Conflict:

> Much of the violence wracking the world since 1989 has been attributed initially to ethnic causes, rooted in immutable history, or to the unavoidable release of tension or redress of grievances held too long in check by the last vestiges of colonialism or the bipolar international structure.[14]

Such ethnic hatred, tension release, or redress of grievances is more apt to occur in the underdeveloped countries vice developed ones. Since the majority of global urbanization is occurring in the underdeveloped countries, the potential for widespread unrest is therefore increasing. For example, in the year 2000, approximately 21 of the world’s 30 largest cities were in developing countries, and, of the 414 cities with one million inhabitants, 264 were in developing

[14] Dake, np.

countries.[15] The most sobering prediction from the United Nations is that 90 percent of the world population growth between 2000 and 2025 will occur in urban areas of the underdeveloped countries![16] And, within this timeframe, those 15 cities achieving the mega-city distinction will all be in underdeveloped areas.[17]

As these cities continue to grow, their inadequate infrastructures are taxed even more, exacerbating the litany of contemporary problems. Merely supplying the basic need for food is a struggle as Oliver Argenti, an urban food specialist with the United Nation's Food and Agriculture Organization, notes: "Supplying them (underdeveloped urban areas) with safe and affordable food will strain the food supply and distribution chain to the breaking point."[18] Massive migration quickly creates more people then job opportunities as evidenced by the estimate that urban poverty rates often exceed 50 percent in underdeveloped countries.[19] No means to pay for suitable housing means people will flock to urban locations with substandard living conditions. These

[15] Dake, np.
[16] Martin P. Brockerhoff, "An Urbanizing World", *Population Bulletin,* September, 2000, np, URL: <http://www.prb.org/Content/NavigationMenu/PRB/AboutPRB/Population_Bulletin2/An_Urbanizing_World.htm#intro>, accessed 4 January 2003.
[17] Brockerhoff, np.
[18] Olivio Argenti, "Feeding an Increasingly Urban World," Food and Agriculture Organization of the United States, May 2002, np, URL: http://www.fao.org/worldfoodsummit/english/newsroom/focus/focus2.htm>, accessed 4 January 2003.
[19] Argenti, np.

"squatters" reside in urban slums with no potable water supply and no adequate sewage, spreading disease amongst them and increasing their mortality rates.

Under the conditions mentioned in the Carnegie Commission's conclusions, these pitiable conditions create "urban powder kegs" capable of erupting into civil unrest, revolution, and religious and political fanaticism.[20] A civil upheaval in one city may have a rippling effect across the world with globally invested nations. Should U.S. foreign investments or political interests become threatened, the military may be called to intervene directly or support a calling nation.

HISTORICAL TREND

Operating in urban areas should not be a surprise for the U.S. military since it has occurred throughout our military's history. However, long forgotten are the early experiences of the sieges and capture of cities during the Mexican-American War and the American Civil War.[21] During our most remembered war, the Second World War, battles were centered on urban concentrations approximately 40 percent of the

[20] Brockerhoff, np.
[21] Michael C. Desch, *Soldiers in the Cities: Military Operations on Urban Terrain*, (Carlisle, Pennsylvania: Strategic Studies Institute, 2001), vii.

time[22] and not merely in the remote islands of the Pacific or the open fields of Europe. During the Korean War, the decisive action that caused the North Korean Army to capitulate in South Korea was not the valiant Pusan defense or the risky Inchon landing, but the seizure of Seoul. And, in the midst of the Vietnam War (largely fought in small to mid-scale jungle and highland actions) the U.S. fought its last large-scale urban battle to date in the South Vietnamese city of Hue.[23]

Aside from the fact that Hue was our last large-scale urban battle, Cold War and post-Cold War operations have still drawn us into urban conflict (which coincidentally, occurred in underdeveloped countries). Operations such as the Multi-National Peacekeeping Force, Beirut, 1982 (Cold War); OPERATION JUST CAUSE, Panama, 1989; OPERATION DESERT STORM, Kuwait, 1991; OPERATION RESTORE HOPE, Somalia, 1993; OPERATION UPHOLD DEMOCRACY, Haiti, 1994, and OPERATION JOINT GUARD, Bosnia, 1996, all provide irrefutable proof that urban operations are a fact of life for the U.S. military. This holds true today, where U.S. forces await possible operations

[22] Major Curtis A. Lapham, USA, *Colossus on Main Street: Tactical Considerations of Heavy Armor and Future MOUT Doctrine*, Monograph (Fort Leavenworth, Kansas: Command and General Staff College, 1996), 2.
[23] Vernon Loeb, "Bracing for 'Primordial Combat,'" *Washington Post*, 31 October 2002, 2.

against the Iraqis who are threatening an urban brawl on the streets of Baghdad.

TACTICAL EQUALIZER – STRATEGIC TRUMP CARD

In Vernon Loeb's October 31, 2002, *Washington Post* article "Bracing for Primordial Combat," he refers to Army Lieutenant General Edwin P. Smith's phrase "the great equalizer" when referring to urban combat.[24] Simply stated, adversaries will look to draw the U.S. into a close urban battle to negate U.S. technological advantages. As Lieutenant Colonel Ralph Peters, responsible for future warfare in the Army's Office of the Deputy Chief of Staff for Intelligence, noted:

> We are becoming so powerful at traditional modes of warfare that we will drive our enemies into environments where our efficiency plummets, our effectiveness drops, and close combat remains the order of the day.[25]

Who can blame them when satellites orbiting high out of harm's way report their positions, dispositions, and movements? Once detected, either by satellites, or aerial drones providing real time intelligence, they are subjected to precision munitions delivered by fighters or bombers well

[24] Loeb, 2.
[25] Lieutenant Colonel Peters, np.

out of range of their surface-to-air missilery. Once U.S. ground forces are employed, our adversaries will have to face a mobile, well-equipped, well-trained, and well-led fighting force. Faced with this challenge, they will sensibly escape to the cities. Today's looming war with Iraq serves to validate our enemy's recognition of the futility of challenging the U.S. in the open:

> Senior Iraqi officials have already said they would try to lure U.S. forces into Baghdad, acknowledging that the Persian Gulf War in 1991 taught them the folly of fighting in the desert against superior American armor and air power.[26]

Despite being considered "second rate", one has to appreciate Iraqi strategy with such a statement. Historically, urban combat produces enormous casualties and damage that some adversaries believe will cause the U.S. public to turn against the conflict. The U.S. scrapped its mission in Somalia soon after 18 Army soldiers were killed and dozens wounded in the 1993 attempt to incarcerate Aideed. Aware of our aversion to casualties and military quagmires, our adversaries will look to undermine U.S. strategic goals with the threat of a prolonged, bloody urban battle.

[26] Loeb, 3.

CHAPTER 3

THE ASSAULT VARIANT

> *It is insufficient to naval expeditionary forces prepared to fight the battles of tomorrow with doctrine and weapons designed for the wars of yesterday*[27]
>
> *What has changed is the gradual shift in relevance from the quantitative characteristics of warfare – mass and volume – to a realization that qualitative factors (speed, stealth, precision, and sustainability) have become increasingly important facets of modern warfare. Maneuver warfare stresses proactive thought and action, elevating the operational art beyond the crude simplicity of attrition.*[28]

The Assault Variant's design breaks with the historical trend of Marine Corps' tank development. That is, the lineage of tanks that becomes increasingly more lethal, yet heavier and more logistically burdensome with each design. For example, our current M1A1 Main Battle Tank (MBT) is unmatched in firepower, mobility, and protection, but at the cost of being a 70-ton class vehicle that consumes seven to nine gallons of fuel per mile. The objective of the Assault Variant program is to create a smaller, lighter, and more

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[27] Krulak, 81.

[28] Headquarters, United States Marine Corps, *Expeditionary Maneuver Warfare: Marine Corps Capstone Concept,* 2001, np, URL: http://www.doctrine.usmc.mil/emw.html>, accessed 13 December 2002. Cited hereafter as Expeditionary Maneuver Warfare.

logistically efficient vehicle, with little or no reduction in current firepower or survivability. To understand this requirement, it is necessary to describe the Marine Air Ground Task Force Expeditionary Family of Fighting Vehicles (MEFFV) Program, and the overarching influences of *Expeditionary Maneuver Warfare* (EMW).

EXPEDITIONARY MANEUVER WARFARE

EMW supports the direction of *Marine Corps Strategy 21* and *Joint Vision 2020* by providing the Joint Commander with a flexible, lethal, and swift force ingrained with the philosophy of maneuver warfare,[29] and capable of operating within the full spectrum of conflict. In order to provide this functionally ready fighting force, EMW utilizes the underlying operational concepts of *Operational Maneuver from the Sea* (OMFTS), *Ship to Objective Maneuver* (STOM), and *Sustained Operations Ashore* (SOA). These operational concepts provide the doctrine to facilitate the introduction of Marine Corps forces in theatre; the maneuver to strike inland centers of gravity; and the ability to sustain high tempo operations once ashore.

[29] Expeditionary Maneuver Warfare, np.

OMFTS capitalizes on the unrestrictive terrain of the open sea to maneuver military power within striking distance of an enemy's critical vulnerabilities.[30] The belief is that the sea provides a protective barrier from which to create a secure medium for assembling forces; attacking inland objectives; and sustaining the inland fight – a sea base. Sea basing is the practical answer to operations along the littorals, facilitating Maritime Pre-positioning Forces and amphibious forces.[31] The STOM concept seeks to launch operations from these sea-bases, then rapidly maneuver inland, bypassing enemy strengths along the shore and striking centers of gravity. This will avoid the degradation of time and tempo, unlike older amphibious operations that must build sufficient combat and combat service support forces on a beachhead prior to moving inland. STOM has such momentum and range that an adversary will become overwhelmed trying to react. Once ashore, our ability to conduct SOA provides the Joint Commander with a versatile force able to "operate not only across the geographical depth of a region, but across the spectrum of conflict and tasks at the same time."[32] To maintain the tempo of these operations ashore, revamped equipment and procedures will reduce overall

[30] Krulak, 82.
[31] Krulak, 82.
[32] Krulak, 83.

footprints, battlefield consumables, and develop more proficient packaging.[33] The Marine Corps has this capability today but present equipment limits the full potential of EMW. The MEFFV Program will provide the future ground systems needed for a more effective application of EMW.

MEFFV VARIANTS

To create this expeditionary capability, the MEFFV Program will replace the M1A1 MBT and the Light Armored Vehicle (LAV) variants with a family of modular, multi-mission, and low maintenance vehicles for assault, reconnaissance, and fire support.[34]

The primary requirement for these vehicles is to increase battlefield mobility by reducing their weight compared to legacy systems. For this, the variants will be either a 10 or 30-ton weight. One 10-ton variant (LAV family replacements) can be externally lifted with the CH-53E heavy lift helicopter and the Landing Craft Air Cushioned (LCAC)

[33] Expeditionary Maneuver Warfare, np.
[34] Ed Walsh, "Marines Looking for Next-generation Land System," Proceedings, July 2002, np, URL: http://proquest.umi.com/pqdweb?Did000000134435051&Fmt=3&Deli=1&Idx=3&Sid=1&RQT=30, accessed 2 October 2002. .

vehicle can carry up to six at one time.[35] For the 30-ton variant, a Landing Craft Utility (LCU) can carry up to three and the LCAC can carry up to two ashore. Reducing the weight of these vehicles increases combat power put ashore with a reduction in ship to shore transportation requirements. The weight savings maximizes transportability and frees amphibious shipping to quickly move other assets of the MAGTF.

The MEFFVs will provide the commander with increased flexibility and tempo by the use of capability modules within the 10 and 30-ton vehicle hulls. With the hull as the common system, modules with different capabilities can be dropped into the hulls to specifically meet the needs of the mission.[36] For example, if a mission requires more fire support, helicopters or MV-22s can fly mortar modules forward in the battlespace to replace reconnaissance modules.[37] Another benefit with the common hull is the reduced need for a diverse repair parts block. Reducing the time and

[35] Colonel Dennis W. Beal, USMC, "MAGTF Expeditionary Family of Fighting Vehicles (MEEFV)," Unpublished Presentation (Quantico, Virginia: Marine Corps Systems Command, October 2002), np.
[36] Major John M. Reed, USMC, *Marine Air Ground Task Force (MAGTF) Expeditionary Family of Fighting Vehicles (MEEFV) – Reconnaissance Variant; Concept Development Validating Operational Maneuver Capabilities in* 2020, Masters Thesis (Quantico, Virginia: Marine Corps Command and Staff College, 2002), 6.
[37] Reed, 6.

resources required to sustain the force in turn increases operational tempo and depth.

Despite the reduction in weight and size, all MEFFV variants will capitalize on advancing composite materials, titanium alloys, and synthesized metals to protect against threat systems of 105 millimeters or less.[38] This is a reduction in protection compared to the M1A1 MBT, but the MEFFV's size reduction will help reduce an adversary's ability to acquire these vehicles and reduce the thermal signature. Further, the future ability to acquire and defeat enemy armor beyond their maximum effect ranges will help the MEFFV survive on tomorrow's battlefield.

ASSAULT VARIANT DESIGN

Within the MEFFV Program, determining the requirements of the Assault Variant will be the most challenging. This stems from the dilemma of retaining our premiere armor protected, tank killing ability in the smaller 30-ton frame. Smaller has traditionally been synonymous with less capable, but MEFFV analysts are looking towards revolutionary systems to offset this imbalance. These "leap ahead" technologies will

[38] Reed, 6.

mature in approximately 2008 giving the program time to test and evaluate these systems well prior to fielding.[39]

FIREPOWER

To satisfy the fundamental mission of the Assault Variant, tank killing, analysts are looking beyond conventional tank guns that utilize bulky propellants. Of the five tank guns considered for the Assault Variant, the electromagnetic gun shows the greatest potential.[40]

The electromagnetic gun, more commonly referred to as a rail gun, operates by passing an electrical impulse through two parallel rails thus creating electrical energy. This energy creates a magnetic field that can propel a projectile at an astounding velocity vis-à-vis a conventional gun. With this capability, a 30-ton tank can easily destroy larger tanks twice its weight and size. Unlike their conventional predecessors, electromagnetic guns do not require a propellant attached to the warhead. This gives the advantage of holding more "stowed kills" (rounds). The gun simply fires the warhead, be it a shaped charge or penetrating rod.

[39] Neil Baumgardner, "Marine Corps Exploring Modular Concept for New Fighting Vehicles," *Defense Daily*, 3 October 2000, np, URL: http://www.proquest.umi.com/pqdweb?Did=00000061921191&Fmt=3&Deli=1&Mtd=1&Idx=8&Sid=1&RQT=309.htm>, accessed 2 October 2002.
[40] Beal, np.

By controlling the amount of energy, you can tailor the muzzle velocity of the round to the threat you will face.[41]

PROTECTION

In the history of tank design, creating a lighter, faster tank inevitably meant sacrificing armor protection; something the Assault Variant cannot afford. Analysts are looking beyond the paradigm of protection as defined by heavy, passive armor. Creating a smaller vehicle and reducing its thermal signature with advanced coatings will reduce the enemy's ability to acquire the vehicle. However, not being seen cannot be its only defense. To create a light, survivable vehicle, several protective systems are being pursued.

Reactive armor is a possibility since this type of protection is in existence today. Reactive armor consists of explosive plates that discharge upon contact breaking the effectiveness of a striking round, be it a shaped charge or penetrating rod. Reactive armor has been battle-tested on various tanks throughout the world, but emerging tank guns

[41] Colonel Brian R. Zahn, USA, *The Future Combat System: Minimising Risk While Maintaining Capability",* Strategy Research Paper, (Carlisle, Pennsylvania: United States Army War College, 2000), np., URL: <http://www.edu/ssp/Publications/working-papers/wp00-2.pdf>, accessed 2 January 2003.
.

can fire ammunition at speeds that will allow the rounds to penetrate reactive armor.[42]

A more advanced armor is electromagnetic armor. This armor consists of two electronically charged plates separated by space. If penetrated by a shaped charge, the penetration creates a short between the plates resulting in an intense electrical discharge. This creates a magnetic field that disrupts the jet's penetrating effects. Such armor may defeat penetrating rods as well.[43]

Even more advanced is active armor. This armor utilizes sensors to acquire an incoming projectile. Once detected, the armor can fire a small plate or an explosion at the incoming projectile and disrupts its trajectory prior to striking the vehicle.[44]

MOBILITY

The overriding question for mobility is whether the MEFFV will be wheeled or tracked. Tracked vehicles have better mobility when negotiating natural terrain as well as manmade obstacles. However, on flat open terrain, wheeled vehicles enjoy the ability of greater speed. For now, this issue may

[42] Zahn, np.
[43] Zahn, np.
[44] Zahn, np.

be inconsequential, but a decision must come sooner, not later so operators can adjust their doctrine based on the vehicle's mobility. Understanding the force's maneuver capability is paramount in maneuver warfare.

Within the mobility debate is the vehicle's engine. The Assault Variant's smaller size means a smaller area to place an engine, so efficiency is key. Currently, analysts are considering engines that run on fuels, such as turbine or diesel engines, or engines powered by high-density batteries. The most likely system will be a parallel system of a high efficiency diesel and a hybrid-electric drive. Certainly, the amount of horsepower created for the Assault Variant is important, but fuel efficiency and its logistics savings cannot be ignored. Lastly, a goal of MEFFV variants, to include the Assault Variant, is an amphibious capability. This seeks to provide mobility across large streams and rivers vice match the capabilities of the Advanced Amphibious Assault Vehicle.

COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS, INFORMATION, SURVEILLANCE, AND RECONNAISSANCE (C4ISR)

Like the other variants in the MEFFV Program, the Assault Variant's C4ISR system has not received the same effort as

the previous capabilities, but this is not an oversight. Due to the rapid pace of information technology development, systems will change in the next seventeen years; therefore, a decision on the appropriate system is being deferred.[45] The Assault Variant will rely on the communications systems being developed to support future EMW within the Marine Corps. These systems will provide the force with a common operating picture synchronizing air-ground actions within the single-battle. Processes such as calls for indirect fire or close air support will be passed via quick digital signals reducing the time for effects on target. Requests for re-supply will utilize similar systems receiving the logistical requests from on-board computers continuously monitoring engine performance and energy consumption.

[45] Beal, np.

CHAPTER 4

TANKS IN THE URBAN FIGHT

Urban combat is the domain of the old-fashioned infantry. But it is not a happy domain.[46]

Applying the Assault Variant to urban warfare means a focus on the tactical level of war. The elements of national power as well as operational assets are needed to facilitate the urban fight, but often, victory in urban warfare is more influenced by tactical level decisions. Urban areas pose complex terrain sets that make command and control (C2) difficult above the small-unit level. Companies and platoons may be able to effect synchronized actions in certain instances, but often, it is the Marine infantry squad leader (General Krulak's "strategic corporal") with various combat support sections that invariably makes the decisive calls.

In addition to degrading C2, urban warfare produces enormous losses in manpower (casualties), equipment, and time; or, operating tempo. Extensive losses in these three categories have the potential to quickly erode the public support, derailing the nation's strategic objectives. It is

[46] Desch, 153.

for these reasons that Marine Corps' preparation for urban warfare has predominantly been at the tactical level.

POST URBAN WARRIOR EXPERIMENTS

The Marine Corps Warfighting Lab's (MCWL) URBAN WARRIOR exercises focused on improving the tactical unit's warfighting capabilities with the simultaneous goal of reducing casualties. Today, the 30 percent casualty rates in urban battles during World War II, Korea, and Vietnam, are unacceptable. Unfortunately, URBAN WARRIOR casualty rates averaged 40 percent per day.[47] Additional experiments were needed.

These additional experiments sought to refine or redefine existing procedures to accomplish tasks quicker and with fewer casualties. These exercises applied combinations of ground combat capabilities such as infantry, tanks, light armored vehicles, combat engineers, and assault amphibians; testing them repeatedly in urban scenarios. At the end of each iteration, participants from each occupational specialty "provided unique developmental perspectives that helped avoid pitfalls and duplicating failed efforts."[48] Over time,

[47] Gangle, 24
[48] Gangle, 25

application of validated procedures reduced the time to complete missions while reducing casualty rates by an impressive 20 percent.

The results of these experiments gave the MCWL a myriad of salient conclusions to take forward. Of these conclusions, the integration of infantry and armor proved to be especially effective. In Kim Burger's "Fighting in the Streets" article in *Jane's Defence Weekly*, the MCWL noted the tank-infantry team as being "almost unstoppable."[49] "Unstoppable" is not to be taken literally; tanks and infantry will be damaged and destroyed in urban battle. What the MCWL meant was that if properly integrated, the tank-infantry team is the premiere choice for urban operations.

THE TANK'S ROLE IN URBAN COMBAT

Though the tank's forte is mobile direct fire in unrestricted terrain, the Marine Corps recognizes its direct fire ability in urban warfare as well. In satisfying this role, tanks will be employed in numerous conditions in urban warfare. Some of these conditions are outlined in the July 2001, *Marine Corps Gazette* article, "Training for Military

[49] Kim Burger, "Fighting in the Streets," *Janes Defence Weekly*, 20 November 2002, 25.

Operations on Urbanized Terrain." These conditions are high intensity military operations on urban terrain (MOUT), precision MOUT, and surgical MOUT.[50]

High intensity MOUT is conducted against an established enemy in an urban area largely void of noncombatants. In this case, the combat within will be high spectrum violence where most, if not all, conventional weapons will be employed against the enemy. High casualty rates and collateral damage are probable outcomes of this type of MOUT.

Precision MOUT is combat where an enemy and noncombatants are both within the urban area during the hostilities. Sensitive to noncombatant casualties, Precision MOUT requires operating with restrictive rules of engagement to circumvent noncombatant casualties and collateral damage.

Finally, surgical MOUT is for a specific purpose and may result in combat depending on the mission. For example, a raid on an enemy command post probably requires fighting, whereas a noncombatant evacuation operation (NEO) may not. For these missions, specialized units are normally used.[51] Surgical MOUT may be used in a MOOTW environment when offensive action is used during peacekeeping missions.

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[50] Roger Hewitt, Douglas Martz, and Thomas McNerney, "Training for Operations on Urbanized Terrain," *Marine Corps* Gazette, July 2001, np, URL: http://www.urbanoperationsjournal.com/training1.htm>, accessed 31 January 2003.

[51] Hewitt, Martz, and Thomas, np.

Regardless of where the operating concept lies in the spectrum of conflict, General Krulak's "three-block war" mantra warns us that all urban operations have the potential to quickly evolve into full-scale combat. As a result, the Marine Corps tasks its tanks to provide the following:

- Suppression and/or destruction of enemy forces within buildings and strongpoints.
- Machine gun suppression fires.
- Reserve or counterattack suppression fires.
- Creating entry/exit points in buildings.
- Isolation of the built-up area or objectives within the built-up area.
- Anti-armor fires.
- Breaching obstacles in a direct fire mode.[52]

OFFENSIVE APPLICATION

In supporting offensive missions, tanks can function within their organic organization (battalion, company, or platoon) or detach companies, platoons, and sections to the appropriate infantry unit.

[52] Department of the Navy, *Marine Corps Warfighting Publication 3-35.3, Military Operations on Urbanized* Terrain (Washington DC: Headquarters, United States Marine Corps, 1998), 4-9, 4-10. Cited hereafter as MCWP 3-35.3.

During attacks (hasty or deliberate), tanks can be used in the isolation phase. Here, tanks move to key terrain outside of urban areas to cut enemy lines of communication, particularly enemy counterattack routes. Tanks may operate with organic assets if the likely enemy threat is an armored counterattack. This prevents any enemy reinforcements from entering the city and interfering with friendly actions. Additionally, from these over-watch positions, tanks can use their magnified optics and thermal sights to locate the enemy. Once acquired, the tanks can either provide direct fire to support maneuver, or pass situational reports to improve the attacker's situational awareness.

Once the urban area is isolated, a foothold in the urban area must be established. Footholds facilitate the tempo of the attack by providing a position to continue operations. Establishing the foothold may require fighting, therefore tanks can provide neutralization and destruction fires with the main gun or suppression with machine guns to support the infantry's seizure of structures. Should structure entrances be heavily defended, the tank can either back into the structure and collapse a wall or use its high explosive rounds to breach walls from a distance. This breaching capability gives the infantry safer access to defended structures.

Finally, in seizing urban objectives, tanks can operate in consonance with infantry units, providing vital direct fire with its main gun and machine guns. With the three-dimensional threat in the city, tanks maneuver under the support of the infantry. Operating behind forward clearing infantry, tanks are summoned forward by the infantry to provide main gun and machine gun direct fire when the infantry is stalled by a well-fortified position or an obstacle blocks the attack's path. Once the position is taken or the obstacle is breached, tanks are bypassed by the attacking infantry and fall back to assume their reserve position. This technique becomes systematic when a series of positions must be taken.[53]

DEFENSIVE APPLICATION

In the defense, the tanks will function primarily against enemy armor. Positioning tanks on the outskirts of an urban area uses their superior standoff range to strip the attacking force of their direct fire assets. Once tanks have obtained their assigned destruction criteria, they can withdrawal into the urban area and assume a subsequent battle position or assume a reserve mission.

[53] MCWP 3-53.3, 2-1 to 2-39

Within the urban areas, tanks can be positioned in hidden anti-armor ambush positions. Here, a tank can assume a hidden position and upon the call of an infantry observer, move to a firing position to deliver fires. Once complete, the tank moves back to its hidden position to await another engagement. Tanks are also beneficial in defending key terrain along the flanks of urban areas or within the urban areas itself. Examples include vital road intersections, bridges, or combat service support areas. Further, should deliberate obstacles be placed to deny the enemy access to the urban area or key terrain, tanks could be used to cover these obstacles with main gun or machine gun fires.[54]

MILITARY OPERATIONS OTHER THAN WAR (MOOTW) – URBAN APPLICATIONS

Tanks are frequently associated with armored fighting only; therefore, they are often forgotten in MOOTW. MOOTW missions are often categorized in the lower spectrum of conflict and tanks are believed to be “over kill” for these missions. This may be true for MOOTW missions conducted in a more passive environment, such as humanitarian assistance or disaster relief. On the other hand, some MOOTW settings can

[54] MCWP 3-35.3, 3-1 to 3-40.

quickly erupt into violence and involve fighting equal in intensity to conventional warfare (e.g. Task Force Ranger, Mogadishu, 1993). Therefore, proper mission analysis is needed to determine whether tanks are appropriate for the given MOOTW mission. If required, tanks provide the joint commander with a heavy capability should a seemingly peaceful situation erupt into intense violence. In these instances, tanks have utility in certain MOOTW functions, particularly when MOOTW occurs in urban areas.

The tank's physical appearance and abilities demonstrate superior military presence in controlling the population. If appropriate, tanks can accompany patrols to project this presence into the populace, or, they can operate stationary at roadblocks and vehicle checkpoints. Their thermal sights become crucial when these duties require 24-hour operations.

The tank's mobility and substantial ordnance capacity make it practical for covering mechanized movement or providing convoy security for lightly armed and equipped re-supply assets. Another use for this asset is to serve as a reserve force, prepared to move into the urban area to support engaged infantry.[55] If committed in this scenario, the tank can withstand small arms fire (protecting the infantry) and take the needed time to acquire the enemy

[55] MCWP 3-35.3, 7-1 to 7-3.

combatants. The tank can then respond with accurate fire on the enemy combatants, minimizing collateral damage and avoiding noncombatant causalities. This is paramount in MOOTW since excessive use of force diminishes the support of the populace and threatens the image of the U.S. military.

ASSAULT VARIANT - SAME TACTICS, DIFFERENT DECADE?

Ironically, the employment of tanks described in the previous paragraphs is similar to tank employment in battles such as Seoul (Korea) and Hue City (Vietnam). Mentioned earlier, tanks were fundamental to the infantry's seizure of key objectives in these two urban battles. Indeed, specific tactics will change, but the constant throughout the last 52 years is that tanks belong in the urban fight. The question is, what about the next seventeen years?

There are no indications that the tank's capabilities will no longer be needed in 2020. The cities described in Chapter 2 will not go away. On the contrary, these cities will continue to grow and if discontent is not properly checked, conflict may arise and the U.S. may become involved. Accordingly, urban warfare will live as long as cities stand. But, how will the MEFFV be employed in 2020? This author would argue that the change in tactics over the next

seventeen years would remain identical to the tactics of 1951. Lieutenant Colonel Peters' article on future armored warfare speaks little of unrestricted terrain. Urban areas are the predicted arenas and "the primary job of armored vehicles will be to protect maneuver, movement, and re-supply."[56] For the purposes of our final chapter, this paper will make the assumption that tank procedures in urban combat will change very little.

[56] Lieutenant Colonel Peters, np.

CHAPTER 5

URBAN-MINDED RECOMMENDATIONS

> "We are becoming so powerful at traditional modes of warfare that we will drive our enemies into environments where our efficiency plummets, our effectiveness drops, and close combat remains the order of the day. We will fight in cities, and we need tanks that can fight and survive in their streets."[57]

Prior to providing urban-minded recommendations for the Assault Variant, it is necessary to recognize the delicate and often frustrating "balancing act" that occurs during equipment development. In the concept phase, good ideas are not hard to find, but whether all of these good ideas can be applied is doubtful. Each new piece of equipment fielded has a background story of compromise. For instance, given limitations such as size, cost, and compatibility, the subcomponents of a weapon system may not be the best quality available. Therefore, the subcomponents chosen may represent the best overall fit when considering all of the limiting factors combined. With this in mind, the proposed recommendations do not attempt to make the Assault Variant into the ultimate urban fighting vehicle at a cost of degrading the Assault Variant's baseline role as a tank. On

[57] Lieutenant Colonel Peters, 3.

the contrary, this paper recognizes the Assault Variant's positive features that will enhance the MAGTF's future warfighting capability.

FIREPOWER

The aggressive exploration of the electromagnetic gun is recommended, not only because of its ability to service emerging tank threats, but because it will alleviate the need for combustible ammunition. Alleviating a round's combustible propellant will create a space savings that will allow the vehicle to carry more ammunition. This is a positive step considering urban battle requires large amounts of suppressive and neutralizing fires. More ammunition gives the Assault Variant a longer "time on station" to support operations and decreases the frequency of risky re-supply operations in built up areas.

With an increase in ammunition load, this paper recommends an increase in ammunition diversity. Priority of ammunition research should be on penetrating rods and shaped charges, but next should come research for advanced multi-purpose warheads. Canister rounds that can destroy infantry formations and demolition rounds that blast huge holes in

reinforced concrete walls or explode with a time delay would enhance ground operations in urban areas.

Regardless of the technological advances in forward target detection, be it from unmanned aerial vehicles or ground maneuvering robots, 100% detection of threat assets is unobtainable in urban warfare. There are simply too many locations for defensive positions and urban engagements occur at short ranges. Therefore, this author recommends the paradigm of a traversable turret with a substantial elevation and depression capability for the main gun. This will give the Assault Variant an all-around direct fire capability to cope with the “three-dimensional” nature of urban fighting.

Lastly, this author recommends that the Assault Variant maintain a diverse suite of machine guns. These machine guns are a must in supporting assaulting infantrymen and may be the only firepower available should rules of engagement negate the use of the main gun in urban areas.

PROTECTION

The ability to “see first, shoot first” may work in the tank’s preferred environment – open areas – but complex urban terrain will reduce, if not negate, this capability. Therefore, it seems logical to recommend tough, passive armor

for an urban designed Assault Variant; however, active armor in open areas has decided benefits. To circumvent this dilemma, this author recommends that the Assault Variant's surface have the ability to apply additional armor protection. These could be "urban enhancement packages" brought forward to increase survivability if moving from an open field environment to an urban setting. The resultant increase in survivability would more than offset the loss of speed due to the increase in weight.

If an active or reactive armor system is chosen, this system could be dangerous to the dismounted infantry operating in close proximity to the MEFFV. Therefore, this paper recommends that the crewmen have the ability to disengage this system for urban fighting. To augment the armor, the aforementioned "urban enhancement packages" could be applied for additional protection.

Lastly, tank armor traditionally focuses on the frontal 60-degree area of the tank since this is the most likely area the vehicle will be hit. This paper recommends that the traditional vulnerabilities in tank armor – top and rear areas – be considered when pursuing the armor system. In urban combat, all surfaces of the MEFFV may be vulnerable.

MOBILITY

A tracked MEFFV is recommended over a wheeled MEFFV. Tracked vehicles not only have better mobility on open areas, but they will have the needed mobility in an urban environment. Urban areas will have dead end streets and tight quarters that trap wheeled vehicles. Faced with this scenario, tracked vehicles can neutral steer to negotiate narrow corridors or conduct 180-degree turns to escape dead end paths. Additionally, urban warfare will produce numerous natural obstacles from the effects of fighting (building rubble) or man-made obstacles such as concrete barriers or burning material. Tracked vehicles have better mobility to move around these obstacles and if required, the ability to drive over the top of them.

Fuel efficient engines or rechargeable battery packs are suitable for urban operations since they will allow the MEFFV to stay in the fight for longer periods of time. This will increase the momentum of operations and reduce the amount of risky re-supply operations. Regardless of the power pack chosen, the MEFFV must have adequate speed for urban combat. This will give the vehicle the ability to sprint forward to deliver direct fire, then quickly exit from potential anti-tank fires. Additionally, this sprint capability will allow

the MEFFV to quickly cross any planned killing zones established by an adversary.

COMMAND AND CONTROL

There is no doubt that the Assault Variant will take advantage of the latest information systems for C2 in future operations. But, this paper recommends the addition of a simple tank-infantry telephone mounted on the rear of the vehicle. Tank-infantry telephones were originally mounted during the Second World War so the infantry could coordinate with the tank. Later tank designs included this system that proved useful during the urban battles of Seoul in 1951 and Hue City in 1968. The current M1A1 MBT does not have a tank-infantry phone system because the M1 series tank was more focused on its tank killing ability. Faced with likely urban operations, the MEFFV needs a tank-infantry phone for simple, direct infantry communication.

TRAINING

As the MEFFV proceeds in design, so to must the design of simulation systems. Today’s M1A1 MBT has a computer simulator that trains the tank gunner and commander’s

coordination in tank engagements. Future simulators must present a variety of realistic urban engagements for main gun and machine gun training. This requirement should be easy to meet with the advancements in computer simulations. It is our responsibility to exploit this capability.

Likewise, live fire gunnery training must incorporate urban engagements. Today's tank units conduct rigorous semi-annual gunnery training but against targets well forward in an open environment. Urban engagements are much different. Targets in urban areas are well hidden and can quickly appear at close ranges to the front, flanks, and even rear areas. This is huge shift in mindset for tank crewman and actual combat is not the time to adjust.

Presently, the tank training and readiness manual (T&R manual) requires periodic training in the traditional missions of tanks – attack, defend, and withdrawal among others. There is no mention of urban essential tasks at the battalion, company, or even platoon level.[58] Likewise, the Marine Corps Combat Readiness Evaluation for tank units does not evaluate any essential task under urban conditions.[59]

[58] Department of the Navy, *Marine Corps Order 3501.23 M1A1 Tank Training and Readiness Manual (Short Title: Tank T&R Manual)* (Washington DC: Headquarters, United States Marine Corps, 1995), np.
[59] Department of the Navy, *Marine Corps Order 3501.14, Marine Corps, Combat Readiness Evaluation System (Short Title: MCCRES) Volume X, Part A, Tank Units* (Washington DC: Headquarters, United States Marine Corps, 1994), np.

These manuals desperately require standards for urban training and the appropriate evaluation to check preparedness. This may appear as more of an administrative correction, but this step is necessary to transform the training mindset to operations in urban areas.

Lastly, the creation of an evaluated urban exercise similar to the combined arms exercise program (CAX) would prepare the participating MAGTFs. The CAX could evaluate the application of combined arms in urban environments within the CAX's workup training and during the final exercise. Again, this will be a major undertaking due to the fact that no urban training facility exists at the Marine Air Ground Task Force Training Command. Despite the time and money, and, the uphill battle transforming a desert training mindset, the long-term benefit is a MAGTF's personnel and equipment prepared for urban warfare.

CONCLUSION

The recommendations mentioned are thought to be both realistic and complementary additions to the Assault Variant's current conceptual design as it relates to the guidance outlined in *Joint Vision 2020*. This guidance charges each service to develop their capabilities with the

steady infusion of advanced technology as it relates to precision engagement, dominant maneuver, focused logistics, and dimensional protection.[60] The “endstate” of *Joint Vision 2020* is a joint force capable of dominating the battlefield and accomplishing its missions regardless of the spectrum of conflict. Regardless of the enemy and the conflict at hand, future operations will likely occur in urban areas; therefore, it is imperative that the Marine Corps continue to build an effective urban capability.

Considering the fact that tanks will continue to play a pivotal role within this urban capability, the present is the time to prepare our next generation tank for urban warfare. By incorporating these recommendations, we will properly equip tank crewman for future urban missions as well as provide the commander with a survivable, direct fire platform to meet the unique challenges inherent in urban warfare.

[60] Taylor, np.

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